PATENT ABSTRACTS OF JAPAN

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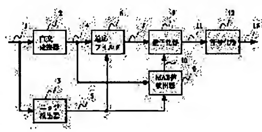
(71)Applicant : CANON INC
(72)Inventor : YAMAMOTO YUKINORI

(54) CODER

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain the coder with an excellent coding efficiency in which deterioration in image quality is suppressed.

SOLUTION: An edge detector 3 detects presence of an edge with a prescribed amplitude or over from a blocked input image signal 1. A MAX value detector 9 detects a maximum value from a coefficient signal 4 in a block subject to orthogonal transformation and controls a quantization width to be increased when the maximum value is high and controls the quantization width not so high when the edge is detected. Furthermore, Furthermore, an adaptive filter 6 filters the coefficient signal 4 while revising the filter characteristic in response to the presence of the edge and gives the result to a quantizer 8.



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CLAIMS

[Claim(s)]
[Claim 1] The coding equipment carry out having had the orthogonal-transformation means carries out the orthogonal transformation of the input picture signal, and output a multiplier signal, the quantization means quantize the input picture signal changed by the above-mentioned orthogonal-transformation means, the maximum detection means detect the maximum of the above-mentioned multiplier signal and control the quantization step of the above-mentioned quantization means according to the value, and the edge-detection means detect in the edge more than the predetermined amplitude of the above-mentioned input picture signal, and adjust quantization step control of the above-mentioned maximum detection means as the description.
[Claim 2] Coding equipment characterized by to have an orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal, a filter means to filter the above-mentioned multiplier signal, a quantization means quantize the output of the above-mentioned filter means, and an edge-detection means detect the edge more than the predetermined amplitude of the above-mentioned input picture signal, and adjust the filtering conditions of the above-mentioned filter means.
[Claim 3] Coding equipment characterized by providing the following. An orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal A filter means to filter the above-mentioned multiplier signal A quantization means to quantize the output of the above-mentioned filter means A maximum detection means to detect the maximum of the above-mentioned multiplier signal and to control quantization of the above-mentioned quantization means according to the value, and an edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned input picture signal, and to adjust the filtering conditions of the above-mentioned filter means, and quantization step control of the above-mentioned maximum detection means
[Claim 4] The coding equipment carry out having had an orthogonal-transformation means carries out the orthogonal transformation of the input picture signal, and output a multiplier signal, the quantization means quantize the input picture signal changed by the above-mentioned orthogonal-transformation means, the maximum detection means detect the maximum of the above-mentioned multiplier signal and control the quantization step of the above-mentioned quantization means according to the value, and the edge-detection means detect the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and adjust quantization step control of the above-mentioned maximum detection means as the description.
[Claim 5] Coding equipment characterized by to have an orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal, a filter means to filter the above-mentioned multiplier signal, a quantization means to quantize the output of the above-

mentioned filter means, and an edge detection means detect the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and adjust the filtering conditions of the above-mentioned filter means.
[Claim 6] Coding equipment characterized by providing the following. An orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal A filter means to filter the above-mentioned multiplier signal A quantization means to quantize the output of the above-mentioned filter means A maximum detection means to detect the maximum of the above-mentioned multiplier signal and to control quantization of the above-mentioned quantization means according to the value, and an edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and to adjust the filtering conditions of the above-mentioned filter means, and quantization step control of the above-mentioned maximum detection means

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used with a digital video tape recorder etc., and relates to the coding equipment for compressing and recording [transmit and] a picture signal.
[0002]
[Description of the Prior Art] The block diagram of conventional coding equipment is shown in drawing 5 . The input picture signal with which it set to this drawing, and 1 was digitized and blocked, The multiplier signal from which 2 was obtained by the DC to AC converter and 4 was obtained by orthogonal transformation, the quantizer with which 8 quantizes the multiplier signal 4, The MAX value detector with which 9 detects the biggest multiplier among the multipliers under block, The encoder which encodes the control signal with which 10 controls the quantization width of face of a quantizer 8 according to the MAX value of a multiplier, the multiplier signal with which 11 was quantized, and the multiplier signal 11 with which 12 was quantized, and 13 are the encoded output signals.
[0003] Next, actuation by the above-mentioned configuration is explained. First, the input picture signal 1 is packed into a 8 pixels long and 8 pixels wide block with the blocking vessel which is not illustrated, and is inputted into DC to AC converter 2. As a method of orthogonal transformation, a discrete cosine transform (DCT) is used well. The picture signal by which orthogonal transformation was carried out turns into the multiplier signal 4, and is supplied to a quantizer 8 and the MAX value detector 9. Although there are DC multiplier which generally expresses a direct current, and the other AC multiplier in the multiplier signal 4 here, the great portion of amount of data is AC multiplier, and if it shall encode about DC multiplier in another circuit (not shown) and is henceforth called a multiplier, it shall point out AC multiplier.
[0004] Next, although a quantizer 8 reduces the amount of data by breaking the inputted multiplier signal 4 by a certain quantization width of face, it detects the largest multiplier among the multipliers of each block with the MAX value detector 9 at this time, and controls quantization width of face according to the size of that value. When the maximum of a multiplier 4 is large, specifically, it works so that quantization width of face is enlarged, quantization width of face may be made small for the cutback effectiveness of the amount of data when the maximum of raising and a multiplier 4 is small, and lowering of S/N of this block may be avoided. thus, the multiplier signal 11 quantized accommodative with the quantizer 8 -- an encoder 12 -- run length coding -- variable length coding is carried out and it becomes an output signal 13. The coding method by such coding equipment is performing control of quantization width of face according to the magnitude of the multiplier within a block, and can be said to be the method which can adjust comparatively easily the trade-off with improvement in compressibility, and image quality degradation by coding.
[0005]

[Problem(s) to be Solved by the Invention] However, since quantization width of face is decided by maximum of a multiplier, the block containing a big multiplier will be quantized by surely big quantization width of face, and image quality degradation may tend to be conspicuous in conventional coding equipment, depending on a pattern. For example, even if the block containing an edge with the big amplitude quantizes by the same quantization width of face compared with the block of a complicated pattern, it has the inclination for image quality degradation to tend to be conspicuous.
[0006] This invention is made in order to improve the above technical problem, and it aims at offering coding equipment with coding effectiveness able to suppress image quality degradation well.
[0007]
[Means for Solving the Problem] An orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal in invention of claim 1, A quantization means to quantize the input picture signal changed by the above-mentioned orthogonal transformation means, The maximum of the above-mentioned multiplier signal was detected and a maximum detection means to control the quantization step of the above-mentioned quantization means according to the value, and an edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned input picture signal, and to adjust quantization step control of the above-mentioned maximum detection means are established.
[0008] In invention of claim 2, an orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal, a filter means to filter the above-mentioned multiplier signal, a quantization means to quantize the output of the above-mentioned filter means, and an edge detection means detect the edge more than the predetermined amplitude of the above-mentioned input picture signal, and adjust the filtering conditions of the above-mentioned filter means have been established.
[0009] An orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal in invention of claim 3, A filter means to filter the above-mentioned multiplier signal, and a quantization means to quantize the output of the above-mentioned filter means, A maximum detection means to detect the maximum of the above-mentioned multiplier signal and to control quantization of the above-mentioned quantization means according to the value, An edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned input picture signal, and to adjust the filtering conditions of the above-mentioned filter means and quantization step control of the above-mentioned maximum detection means is established.
[0010] The orthogonal-transformation means carries out the orthogonal transformation of the input picture signal, and output a multiplier signal in invention of claim 4, the quantization means quantize the input picture signal changed by the above-mentioned orthogonal-transformation means, the maximum detection means detect the maximum of the above-mentioned multiplier signal and control the quantization step of the above-mentioned quantization means according to the value, and the edge-detection means detect in the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and adjust quantization step control of the above-mentioned maximum detection means have prepared.
[0011] In invention of claim 5, an orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal, a filter means to filter the above-mentioned multiplier signal, a quantization means to quantize the output of the above-mentioned filter means, and an edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and to adjust the filtering conditions of the above-mentioned filter means have been established.
[0012] An orthogonal transformation means to carry out orthogonal transformation of the input picture signal, and to output a multiplier signal in invention of claim 6, A filter means to filter the above-

mentioned multiplier signal, and a quantization means to quantize the output of the above-mentioned filter means, A maximum detection means to detect the maximum of the above-mentioned multiplier signal and to control quantization of the above-mentioned quantization means according to the value, An edge detection means to detect the edge more than the predetermined amplitude of the above-mentioned multiplier signal, and to adjust the filtering conditions of the above-mentioned filter means and quantization step control of the above-mentioned maximum detection means is established.
[0013]
[Embodiment of the Invention] Drawing 1 shows the block diagram by the gestalt of operation of the 1st of this invention. The input picture signal with which it set to this drawing, and 1 was digitized and blocked, The edge detector with which 2 detects a DC to AC converter and 3 detects the edge within the block of the input picture signal 1, The adaptation filter which the multiplier signal from which 4 was obtained by orthogonal transformation, and 5 respond to an edge detecting signal, and 6 responds to the existence of the edge detecting signal 5, and filters the multiplier signal 4, The multiplier signal with which 7 was filtered, the quantizer with which 8 quantizes the multiplier signal 4, The MAX value detector with which 9 detects the biggest multiplier among the multipliers under block, The encoder which encodes the control signal with which 10 controls the quantization width of face of a quantizer according to the MAX value of a multiplier, the multiplier signal with which 11 was quantized, and the multiplier signal 11 with which 12 was quantized, and 13 are the encoded output signals.
[0014] Next, actuation by the above-mentioned configuration is explained. It is collected into a 8 pixels long and 8 pixels wide block like the conventional example, and orthogonal transformation of the input picture signal 1 is carried out by DC to AC converter 2, and the multiplier signal 4 is acquired. Moreover, the input picture signal 1 is inputted also with the edge detector 3, it is judged whether the image block contains the edge more than the predetermined amplitude, and a judgment result is outputted as an edge detecting signal 5. The multiplier signal 4 and the edge detecting signal 5 are respectively inputted into the adaptation filter 6 and the MAX value detector 9.
[0015] Although a control signal 10 is outputted so that quantization width of face may be made small when small, even when the MAX value detector 9 detects the largest multiplier among the multipliers within a block like the conventional example, it is large in quantization width of face when the value is large, the edge detecting signal 5 is truth (i.e., when the edge more than the predetermined amplitude is included) and a MAX value is large, it controls to seldom enlarge quantization width of face. As mentioned above, this is because image quality degradation by quantization distortion tends to be conspicuous, when quantization width of face is enlarged in the block containing an edge, and it is for improving the active jamming generally called block distortion or a mosquito noise. However, with the adaptation filter 6, since the problem that compressibility falls in having controlled quantization width of face simply arises, when the edge more than the predetermined amplitude is detected, the signal 7 filtered to the multiplier signal 4 for the amount-of-data cutback is supplied to a quantizer 8.
[0016] The situation of filtering with the adaptation filter 6 is shown in drawing 2 . This drawing (a) shows AC multiplier train immediately after orthogonal transformation, an axis of ordinate is the gain (absolute value) of a multiplier, and the axis of abscissa shows such a high frequency component that it goes to the right. In addition, although a actual multiplier is arranged two-dimensional, it is expressed by one dimension here for simplification. This drawing (b) and (c) show the example of a property of a filter, are the property that (b) attenuates a high region smoothly, and the property that (c) cuts a high region thoroughly, and show the result after a filter respectively to (d) and (e). Since the gain of the multiplier within a block becomes small by filtering, zero run increases in latter coding processing, the number of symbolic languages decreases or, in any case, the amount of data -- code length's shorter code is assigned -- is committed in the direction which decrease in number. Consequently, when an edge exists and quantization width of face is controlled, it becomes possible to

stop the amount of data which increases from original quantization. In addition, filtering is not performed when an edge is not detected (the edge of the small amplitude is also included).
[0017] According to the gestalt of this operation, by controlling the MAX value detector 9 which controls quantization width of face according to the maximum of the multiplier within a block, and the adaptation filter 6 which filters the multiplier itself directly by the signal 5 which detected the edge more than the amplitude predetermined [within a block], the increment in the amount of data can be suppressed and coding equipment with little image quality degradation can be obtained.
[0018] The block diagram by the gestalt of the operation of the 2nd of this invention to drawing 3 is shown. Since only the input signal of the edge detector 3 differs from drawing 1 , explanation of operation is extracted to this point, and omits explanation about other actuation. With the gestalt of this operation, edge detection is performed not using the input picture signal 1 but using the multiplier signal 4 by which orthogonal transformation was carried out. This is for simplifying the circuitry of the edge detector 3, as edge detection is performed in simple.
[0019] Drawing 4 shows the multiplier location for 1 block after orthogonal transformation. an upper left black part is DC multiplier, and the notation of a, b, and c shows the location of the low-pass AC multiplier near the DC (one or more), and expresses the multiplier of each, length, width, and the direction of slant. When a big edge is in a block, it is not necessarily in agreement with accuracy, but since the multiplier of the location of these a-c becomes large, as compared with a predetermined value etc., edge detection can be performed in simple.
[0020] Since the content of processing is also alike using the comparator etc., both can collect into one by considering the multiplier signal 4 with same edge detector 3 and MAX value detector 9 as an input in drawing 3 , and circuit magnitude can also be saved further. According to the gestalt of this operation, while being able to save the circuit magnitude of the edge detector 3, the increment in the amount of data can be suppressed like the gestalt of the 1st operation, and coding equipment with little image quality degradation can be obtained.
[0021]
[Effect of the Invention] Since according to invention of claim 1 the maximum of a rectangular transform coefficient and the edge more than the predetermined amplitude of an input picture signal are detected and a quantization step is adjusted as explained above, coding equipment with little image quality degradation can be obtained.
[0022] Since the filtering conditions at the time of detecting the edge more than the predetermined amplitude of an input picture signal, and filtering the multiplier signal after orthogonal transformation are adjusted according to invention of claim 2, the coding equipment which suppressed the increment in the amount of data with the easy configuration according to the pattern of an input picture signal can be obtained.
[0023] Since according to invention of claim 3 the filtering conditions at the time of detecting the edge more than the predetermined amplitude of an input picture signal, and filtering a rectangular transform coefficient, and the maximum of a rectangular transform coefficient and the edge more than the predetermined amplitude of an input picture signal are detected and a quantization step is adjusted, the increment in the amount of data can be suppressed according to the pattern of an input picture signal, and coding equipment with little image quality degradation can be obtained.
[0024] According to invention of claims 4-6, by having constituted so that edge detection might be performed not using an input picture signal but using the multiplier signal after orthogonal transformation, simplification of a circuit can be performed and the same effectiveness as invention of claims 1-3 can be acquired.

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TECHNICAL FIELD

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PRIOR ART

[Description of the Prior Art] The block diagram of conventional coding equipment is shown in drawing 5 . The input picture signal with which it set to this drawing, and 1 was digitized and blocked, The multiplier signal from which 2 was obtained by the DC to AC converter and 4 was obtained by orthogonal transformation, the quantizer with which 8 quantizes the multiplier signal 4, The MAX value detector with which 9 detects the biggest multiplier among the multipliers under block, The encoder which encodes the control signal with which 10 controls the quantization width of face of a quantizer 8 according to the MAX value of a multiplier, the multiplier signal with which 11 was quantized, and the multiplier signal 11 with which 12 was quantized, and 13 are the encoded output signals.
[0003] Next, actuation by the above-mentioned configuration is explained. First, the input picture signal 1 is packed into a 8 pixels long and 8 pixels wide block with the blocking vessel which is not illustrated, and is inputted into DC to AC converter 2. As a method of orthogonal transformation, a discrete cosine transform (DCT) is used well. The picture signal by which orthogonal transformation was carried out turns into the multiplier signal 4, and is supplied to a quantizer 8 and the MAX value detector 9. Although there are DC multiplier which generally expresses a direct current, and the other AC multiplier in the multiplier signal 4 here, the great portion of amount of data is AC multiplier, and if it shall encode about DC multiplier in another circuit (not shown) and is henceforth called a multiplier, it shall point out AC multiplier.
[0004] Next, although a quantizer 8 reduces the amount of data by breaking the inputted multiplier signal 4 by a certain quantization width of face, it detects the largest multiplier among the multipliers of each block with the MAX value detector 9 at this time, and controls quantization width of face according to the size of that value. When the maximum of a multiplier 4 is large, specifically, it works so that quantization width of face is enlarged, quantization width of face may be made small for the cutback effectiveness of the amount of data when the maximum of raising and a multiplier 4 is small, and lowering of S/N of this block may be avoided. thus, the multiplier signal 11 quantized accommodative with the quantizer 8 -- an encoder 12 -- run length coding -- variable length coding is carried out and it becomes an output signal 13. The coding method by such coding equipment is performing control of quantization width of face according to the magnitude of the multiplier within a block, and can be said to be the method which can adjust comparatively easily the trade-off with improvement in compressibility, and image quality degradation by coding.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the gestalt of operation of the 1st of this invention.
[Drawing 2] It is property drawing showing the situation of filtering of a multiplier signal.
[Drawing 3] It is the block diagram showing the gestalt of operation of the 2nd of this invention.
[Drawing 4] It is the block diagram showing arrangement of a two-dimensional multiplier signal.
[Drawing 5] It is the block diagram showing conventional coding equipment.
[Description of Notations]
1 Input Picture Signal
2 DC to AC Converter
3 Edge Detector
4 Multiplier Signal
5 Edge Detecting Signal
6 Adaptation Filter
7 Multiplier Signal after Filter
8 Quantizer
9 MAX Value Detector
10 Quantization Width-of-Face Control Signal

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